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such a state of perfection could be reached. The foremost condition will be the rational construction of *enclosures*—not cages—liberal in extent, and in strict accordance with the respective habits and instincts of the animals to be confined. *Cages* cannot well be avoided by traveling menageries; in zoölogical gardens they are inexcusable.

Of the late Mr. Darwin, it is said that “he seemed by gentle persuasion to penetrate that reserve of nature which baffles smaller men.” How much to be regretted that Mr. Darwin was not commissioned to reconstruct the great London “Zoo” in Regent’s Park!

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THE COPPERHEAD.

BY RICHARD E. KUNZÉ, M.D.

ON the last day of August of this year, I had the good fortune to come within an unpleasantly close proximity of the head of *Ancistrodon contortrix* without being bitten by that reptile, and from the peculiar circumstances connected with it, I am led to propound these questions:

1. Does *Ancistrodon contortrix* ever strike at an enemy without being coiled up in that characteristic attitude of *Crotalus durissus*, previous to the latter’s giving his fatal blow and while sounding his rattle?

2. Does *A. contortrix* ever feign death?

The reason why I am prompted to ask these questions is, because the only other specimen of the copperhead I ever met during a period of twenty-nine years of collecting, was one I encountered in a coiled up and striking attitude, as I supposed, and under circumstances which I will further on relate. Yet I am fully aware that the rattlesnake, when striking in order to seek food, does not first coil himself nor even sound his warning note previous to striking the fatal blow. These observations I have verified on a caged specimen, as reported in Nos. 21 and 22 of Vol. I of *Science News* in the year 1879.

On the day mentioned I collected a quantity of *Monarda punctata* in New Jersey, a quarter of a mile from the depot of Matawan, in Monmouth county. The field where I obtained the horsemint, of which I use considerable for medicine, was a narrow strip of fallow land in the same enclosure with a cornfield to

the west, an extensive swamp to the east, and bounded by the New York and Long Branch R. R. on the north, near the junction of the Freehold and New York R. R. This uncultivated lot was overgrown with many plants of *Monarda*, *Apocynum cannabinum*, a few *Millefoliums*, *Asters*, and much more of *Cenchrus tribuloides*, the annoying hedgehog-grass. Here and there in the sandy ground were a few *Rubus canadensis* and *Cassia chamaecrista*, which made up the vegetation of the spot, not covering more than half an acre all told. It was gently sloping towards the swamp, the steep bank of which, nearly twenty-five feet high, was covered with bushes and a rank undergrowth of weeds and briars, a fit lurking place for reptiles, and more so perhaps because on the side nearest the railroad trestle a number of springs poured their pure water down over the shady declivity, making it a resort for birds and other animals.

Having missed an earlier train, I did not arrive on the ground until after 4 P. M., when the sun was fast receding in the west. I took a hasty stroll over the field to better understand where to commence work, and in so doing walked directly over, or past the locality where I afterward met the copperhead without having observed anything unusual. Having had a kind of presentiment all the morning and ever after, that I might possibly come across an *Ancistrodon*, which I did not have the slightest wish to do, I could not help examining all the ground most carefully before me, and so much so that it more than annoyed me during the short time left for work.

While thus engaged cutting with my right hand the *Monarda*, which I carried in the left, and while slowly moving in the direction of the cornfield, with my back to the swamp and the rays of the sun lighting up the ground before me, I instinctively drew back a step on the discovery of a triangular-looking object before me close to the ground, the other end of which was partly hidden by intervening plants. Taking a hasty second look, I noticed that it was the head of a serpent with the body stretched in an opposite direction, and to all appearance dead or motionless. With the glare of the sun in my face and an otherwise defective eyesight, I could not, from where I stood, fully observe the condition of the reptile's eyes, so as to assure me whether he was dead or alive. Taking another step or two south of where I previously stood, I was enabled to take a lateral view of the ophidian,

and at a glance discovered an unmistakable light issuing forth from the latter's eyes, which warned me to be on my guard.

While I must have impeded the serpent's progress, gliding as he did toward the embankment of the swamp, and not ten feet from the edge of it when first noticed, the snake must have been as much surprised at my intrusion upon his siesta ground, as I was. It seems as if he had suddenly discovered my presence and was fully aware of my peaceful intentions, when I found myself face to face with him at a distance of only fifteen to eighteen inches from between his wicked-looking eyes and my hand. He must have come to a sudden halt with the form of his body still indicating the previous gliding motion. The head and neck was pressed closely to the ground, and the former unusually flat.

After stepping to one side I took him to be a yellow rattler, so very deceptive were his colors, but a glance at his tail revealed the absence of the horny appendage. He appeared not to be more than two feet in length, and was as thick in the middle third of his body as a rattlesnake of twice that length, in fact, fully as broad as my wrist. The appearance of the entire body was that of complete relaxation, and presented an unusually broad surface of body, the same as that I have often witnessed in rattlesnakes I formerly had while asleep. Even the dorsal line was raised much above the sides, which gave the back a triangular shape, much the same as in *Crotalus*.

It was out of the question that it could be *Heterodon platyrhinos*, because the blowing viper has a thicker neck and tail, and is differently marked and colored, whereas this serpent had a very constricted neck close to the head, and a more slender caudal extremity; nor would it hiss or blow, which is so characteristic of *Heterodon*.

I next thought that it might be *Pituophis melanoleucus*, when it occurred to me that a pine snake of such a thickness should be at least thrice as long if not more so, and then the very flat, triangular head precluded such a possibility as that, not to speak of the color, which the specific name would indicate.

And it was not a species of *Tropidonotus* either, although at a distance some of the duskier specimens might be taken for a copperhead. But we never find water snakes very far from their element. Many years ago, when collecting many Chelonians for my brothers in Germany, I frequently started up unusually fine speci-

mens of *Tropidonotus* beside their element. But as every one knows, their movements are far from sluggish.

Under exciting circumstances one cannot take in the whole situation at once. The ground work of the flanks of my ophidian was of a beautiful clear yellow, intermediate between a lemon and orange shade, much brighter than a cream-yellow, and which prevented me from determining him at first as an *Ancistrodon contortrix*. The specimens I had seen, dead or alive, were all more or less of a dusky color or dirty gray, where this one was of a yellow hue. The bright, chestnut-colored, inverted Y-shaped blotches on the sides seemed to be confluent on the dorsal line with those from the other side, giving the back an appearance of continuous bands. It was these bands which at the first glance made me think that I had a yellow *Crotalus* before me, although I very much doubt whether Monmouth county at present can produce such a variety. Perhaps Professor S. Lockwood can inform us whether such ophidians still inhabit that part of New Jersey.

It presented anything but the "graceful lines" in which Hagarth describes the much-abused ophidian. The only graceful portion of this specimen consisted in a few inches of a slender and cylindrical caudal extremity. That portion of the body from the region of the anus to within a few inches of the constricted part of the neck, was disproportionally thick. The large flat, triangular head with its sunken features, so suggestive of the hippocratic face of a moribund individual, was anything but assuring; and its wicked-looking eye was suggestive of "touch me if you dare."

However, in point of color he was a rare beauty; the bright and clean-looking scales reflected the sunlight in a degree second only to a varnished leather belt. The blotches on the dorsum and sides in shade of color resembled that of a horse-chestnut. His snakeship looked as if he had just donned a new suit, so bright and well defined were the colors and markings. In fact, shortly thereafter I found an ophidian "overall," and not very far from where I encountered him. I think that the fashionable "skin-tight trousers" belonged to my *Ancistrodon*. I threw the skin over an Indian hemp plant, calculating to take it home with me for future identification, when on looking for it afterwards I found it was gone. A light breeze might have lifted and carried it off.

I now came to the conclusion to capture that serpent either dead or alive. In looking around I could not see a stone as large as a hickory-nut, nor a stick nearer than forty or fifty feet distant. I cut one from an aspen sapling leaving it notched at the end. The spot where I left the ophidian, apparently as motionless as ever, was marked by a lot of cut horsemint, and when I returned the reptile had given me the slip, and without any doubt resumed his interrupted journey toward the swamp.

I spent some time in looking for him on the field, and even started up another colubrine specimen resembling *Ophibolus clerici* B. & G. (syn. *Coluber eximius* Holbr.), over three feet long, which hastily glided down the bank of the all-protecting swamp. The latter would prove an El Dorado to the herpetologist.

It being near even-tide I cautiously resumed my work beside that swamp, but could not help thinking of Mr. Whittier's lines addressed to the Amphisbæna, that

“ Far away in the twilight time
Of every people in every clime,
Dragons and griffins and monsters dire,
Born of water and air and fire,
Or nursed like the Python in the mud
And ooze of the old Deucalion flood,
Crawl and wriggle and foam with rage,
Through dusk, tradition and ballad age.
* * * * * *
* * * * * *”

During the remainder of the day and evening I could think of nothing else but that Ancistrodon. How close it permitted me to approach him without showing any signs to resent my familiarity, although the latter was unintentional on my part!

It is barely possible that I lacked just a few inches too far off for his aim, and thereby providentially escaped being struck by his deadly fangs. The effect of this episode on my mind is better understood by the following dream, which disturbed my rest that night :

I imagined myself beside a large meadow in a ducal park, where my father had been horticulturist-in-chief, and where in early youth we children used to play. All at once two great serpents raised their heads above the grass and with their bodies reaching across the entire field, commenced to thrash the green sward. Finally the giant ophidians grew larger and still larger, until they appeared to vie in size with the sea-serpents of the

New York Sun. This was too much of a strain on the exhausted condition of the dreamer, and making, as I suppose, a frantic effort at escape, I awoke to find myself in bed and in a not very rested condition of either body or mind. And it was not to be wondered at either, after knowing

“Of that sea-snake, tremendous curled,
Whose monstrous circle girds the world.”

Nearly fifteen years ago, on or about the middle of October, I went with a friend to a swamp east of Yonkers, in Westchester county, N. Y., for the purpose of enjoying a day's shooting. On the edge of the swamp we flushed a covey of quail, which scattered in the open on the hillside beyond. My setter soon took up the scent again and presently came to a “dead point” in front of a little cedar tree. As soon as we came up, I ordered Major to “go on” and flush the game, which he refused to do, nor did he obey any future commands to the same effect. Telling my companion to advance on one side of the dog, I passed around the other side of the cedar, where to my horror I discovered a copperhead all coiled up, with his head elevated, and ready to give my dog a warm reception. I shouted “heel up” to the dog but he refused to stir, and finally walked back and seizing Major by the collar dragged him out of the way of harm. My friend then stepped up and killed the serpent with a charge of shot. It measured nearly twenty-four inches, and was of rather a dusky color throughout. The specimen was badly mutilated, and first removing its poison fangs, I left it on the field. My setter was blind in one eye, and it made me all the more apprehensive for his safety.

Twenty years ago I received from a friend living on the banks of the Hudson, between Spuyten Duyvil and Riverdale, in Westchester county, a fine specimen of a copperhead, which had been killed close to the door of his residence, built on terraced ground, and adjoining the property of the late Judge Whiting.

He and another friend having but just returned from a shooting trip on the hill, were seated under a grape arbor which covered one of the terraces running parallel with the rear entrance of the mansion. Their fowling-pieces stood within easy reach behind the open door. Of a sudden a rustling sound was heard in the leaves just back of their seat, and a moment later a frightened toad hopped down the embankment, when to their surprise he

was followed by an *Ancistrodon contortrix*, which, on reaching the terrace, was almost ready to pounce upon his intended victim. It was but the work of a moment for one of the astounded observers to draw the ramrod from a gun, with which he killed the serpent, giving the batrachian a chance to escape.

It was a remarkably fine specimen of a serpent, measuring, I believe, thirty-two or thirty-three inches in length, and but little lacerated by the blow from the ramrod. I afterward presented it to the Museum of Natural History of this city (New York). The markings of this reptile were well defined, and the blotches of a good chestnut color throughout. The ground color was rather of a light grayish-brown, and far from yellow.

Several other specimens of living *A. contortrix*, which I have seen on exhibition in different places of this city, were all free from that yellow color which distinguished the ophidian I met so unpleasantly close at Matawan, N. J.

It is stated in "Ophidians," by Dr. S. B. Higgins, that the copperhead invariably bites low, in contradistinction to the *Crotalus*, inflicting a wound in the region of the ankle joint both in man and animals. If this be so, then the act of coiling previous to striking at a foe could be dispensed with. In Higgins' work, which principally treats of the poisons and their galls as antidotes against the bites of all venomous ophidians, the copperhead is designated as *Ancistrodon contortrix* B. & G.

As I find so little published in scientific literature about the habits of the copperhead, I must have recourse to some accounts clipped from newspapers. They illustrate one point in question, and which relates to the part wounded when human beings have been the victims. Another fact learned from the same source refers to the number of young of the copperhead, which compares quite favorably with statements regarding other serpents made in the volumes of the AMERICAN NATURALIST, by various informants.

From the New York Sun (Aug. 29, 1880).—In Reading, Pa., a copperhead snake, thirty-seven inches long, was found to contain eighty-eight young snakes, all alive, and four to six inches in length, when it was killed by James F. Hinkle.

From the New York Sun (Oct. 24, 1880).—Lewis C. Wilson, of Washingtonborough, Pa., killed a large copperhead snake which, when opened, was found to contain sixty young ones.

From the Oil City Derrick—New York Sun (July 13, 1879).—Wednesday evening a little boy named Mishler, whose parents

reside in the lower end of the Third ward, in what is known as Irishtown, was bitten by a copperhead snake. He was playing at the corner of the house when bitten, and ran to his mother at once. He told that a snake had bitten him, and then jumped over his head. The lad showed a small red spot on his ankle where he said the bite was. The mother thought it was only a bee sting, and paid no attention to it until the wound began to swell. Then the doctor was sent for, who pronounced it a snake bite, and gave remedies at once. The boy was then carried to where he said he had been bitten, when the snake was found there coiled about a burdock plant. He was an ugly-looking reptile, and was quickly despatched with an axe. The boy was doing quite well last night, and there are hopes of his recovery.

From the New York Sun (Aug. 29, 1880).—While picking blackberries on the Mine Hill mountains, Mary O'Brien, of Black valley, Pa., felt something rubbing against one of her stockings. She continued picking berries, and next felt a sharp and sudden pain in that limb. Springing out from the bushes she found a copperhead, over a yard in length, coiled about her leg, and without an instant's loss of self control, she took the snake by the tail, and after unwrapping it dashed it to the earth and beat it to death with a club.

From the Philadelphia Times (Reading, Aug. 21, 1879).—At the camp meeting of the Evangelical Association near Sinking Springs, this county, Mrs. Mary Deitzel, aged sixty-five, a sister of the presiding elder, Rev. J. M. Saylor, was so badly bitten by a copperhead snake this morning, that she was brought to Reading in an unconscious condition. * * * * * Mrs. Deitzel desired to prepare an early breakfast. She reached down under the stove to get some kindling wood that had been placed there to dry. When her left hand had been withdrawn from under the stove, Mrs. Deitzel felt a slight pain. She saw a drop of blood on the knuckle of the first finger of the left hand. She thought that probably a splinter had pricked her, or that a wood mosquito or a spider had stung her. As her hand and arm commenced swelling and getting stiff, she became alarmed. A search was made. Under the stove, in a coil, was a poisonous copperhead snake. The finders instantly despatched it. It was sixteen inches in length, and was quite thick. It was brown on top and flesh-colored underneath.

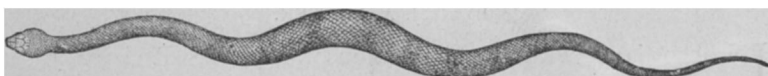
From the New York Sun (Oct. 24, 1880).—A copperhead snake bit Mrs. Henry Overart, of Concord, N. C., on the little finger of her left hand, and she died before medical aid reached her.

I have been informed by another physician, that two years ago a surveyor employed by the West Shore Railroad, while at work near Highland, Ulster county, N. Y., was bitten in the ankle by a

copperhead. It was with the utmost care and exertion that his life was saved.

Other instances of "copperhead bites" I could cite from the "snake columns" of the *New York Sun*, where death even resulted in consequence of the injury received. But the locality of the bite not being mentioned, it would not serve the purpose of showing where such injuries are generally inflicted.

It has been said by Mr. J. A. Graves, a veteran showman, who may be found at Bunnell's Museum, of this city, that a snake stretched out in a nearly straight line could not bite. As, for instance, in such a position as this:



And if a copperhead should place himself in this shape,



all a man would have to do, would be to throw him out of position with his cane, and then he could not bite him.

The copperhead I found at Matawan, N. J., did not place himself in such an aggressive attitude, if it may be so called. The head and tail were in one line, as it were, with the intermediate parts lying in easy curves, just as we observe it in the gliding movements of such a serpent.

Since the foregoing was written I met a brother physician, who was born and raised in Dutchess county, N. Y., and he told me that in his boyhood he frequently found and teased the copperhead or pilot, so-called, only a few miles south of Poughkeepsie, and what is now known as Milton Ferry, on the Hudson River Railroad. A little above that place, and what was known as Spachen Kill, a creek connecting with Gill's millpond, was a swampy neighborhood infested with copperheads. They were so plentiful that many of the laborers employed in building the Hudson River R. R. at that place were bitten by those reptiles,

and a number of the men died. A house standing in the vicinity was so much troubled with those and other snakes, who sought refuge in the cellar, that it was burned down and allowed to remain in ruins, no one caring to live there. Dr. C. H. Yelvington told me that the copperhead *never* bites when coiled up. But he will throw the middle of his body into long, almost rectangular curves, as the above drawing indicates, and with his head and an inch or so of the neck slightly elevated above the ground, is ready to defend himself.

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EXPERIMENTS WITH THE ANTENNÆ OF INSECTS.

BY C. J. A. PORTER.

IN accordance with the suggestion of Dr. A. S. Packard, Jr., in an article published by him in the *NATURALIST*, Vol. XI, page 418, and also in pursuance of the plan hinted at by Mr. L. Trouvelot (*AMER. NATURALIST*, Vol. XI, page 193), I made, during the season of 1878, some pretty extensive experiments on the antennæ of insects with the view of finding out, if possible, what is the function, or functions if there may be several, of this part of the insect economy. I experimented with a great many individuals, and these of many different species of insects, and give below an account of a few of these experiments, together with the conclusions I have ventured to draw from the whole. Not that I would say the experiments are in any way exhaustive, or that the conclusions drawn are altogether correct, but I present them that I may do something to excite others, who may be more competent, to turn their attention and spare moments to this subject, which all will no doubt agree it is certainly time to investigate more freely than it has been heretofore. I have selected from my notes such experiments as seem best to represent the whole, and it will be noticed by those who have read the above-mentioned papers, that in some respects our results differ, while in most instances they agree. The differences, however, may be due to variations of experiment.

1. I found a large humble-bee on a clover stalk a few rods from my room; I caught it by throwing my handkerchief over it, and then carrying it home, I placed it in a glass fruit-can in order to let it recover if in any way it might have been injured by the capture or carrying. When it seemed to have been in sufficient